Coalition Interoperability Ontology:

Sharing Situational Awareness
with Allies and Agents

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Disclaimer

- This presentation is not based on the paper prepared by Dr. Michael Wunder, FGAN.

- However, the presenters strongly support the idea to use data model driven ontologies to support coalition interoperability.

- In particular, both of them are supporting the use of the NATO Generic Hub model, also recommended by Dr. Wunder.

- It is highly recommended to read the paper of Dr. Wunder to gain insights in his viewpoints.

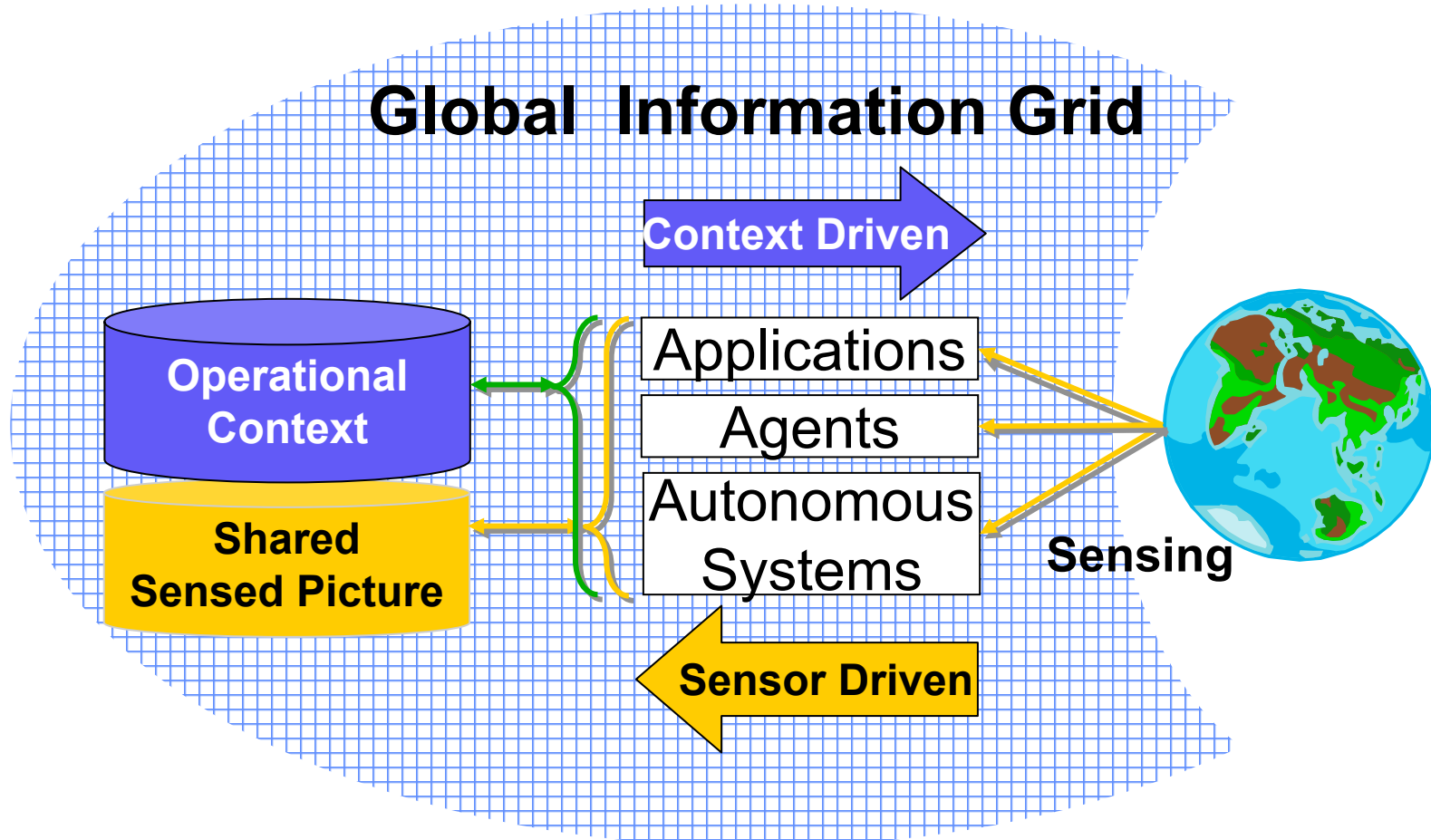# Decision Support Essentials

- Military decision maker
  - Intelligent part of today's system
- Scenario
  - Well trained
  - Perfect Tactical Picture
- Decision makers Need Context to make decisions
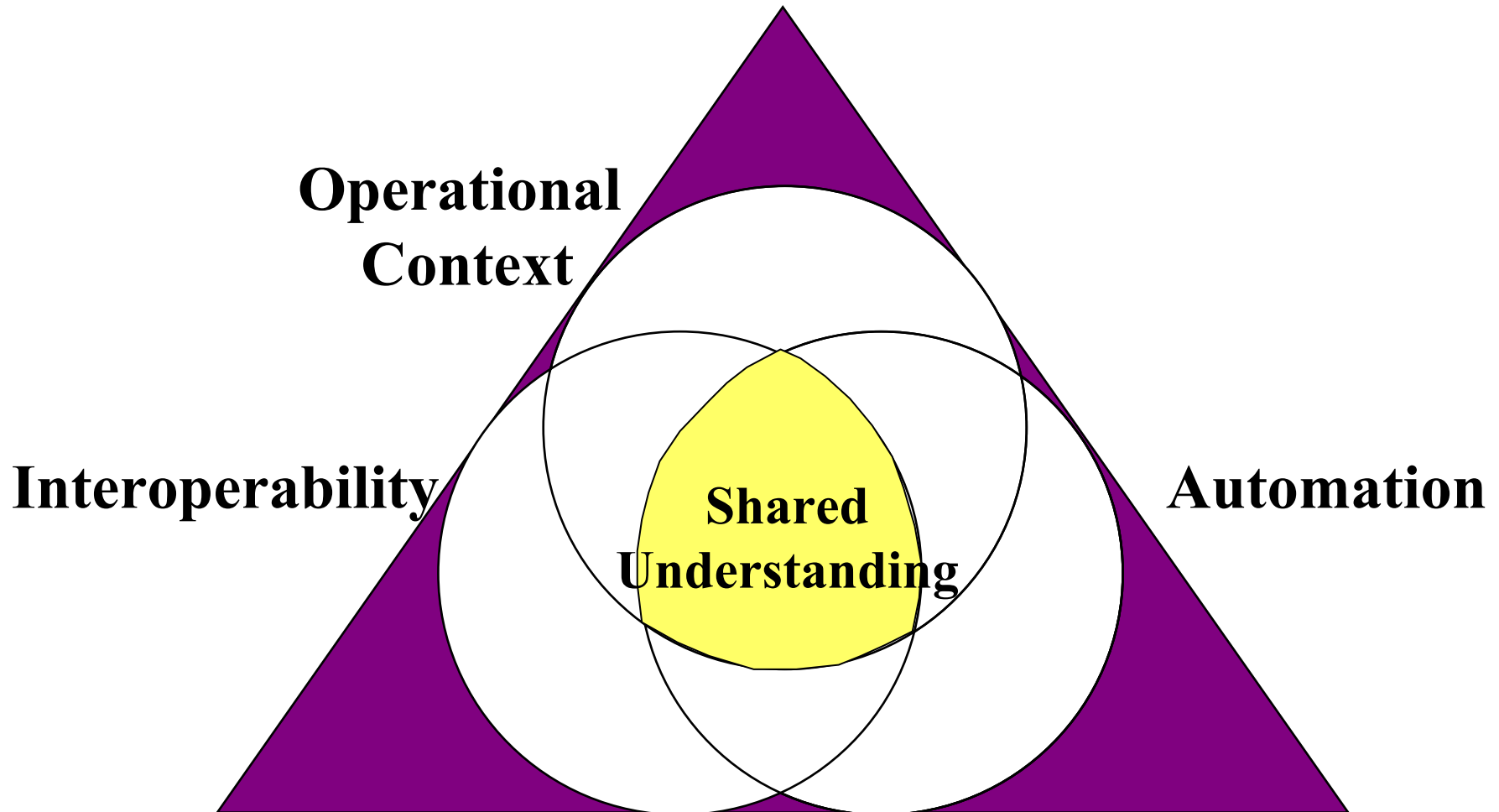
Operational Context is today maintained in the warfighter "part" of tactical and command and control systems.

Operational Context

- The wide range of static and dynamic information about the military operations and the battlespace including:

  - the scope of operations
  - command relationships
  - task force order of battle
  - mission assignments/objectives
  - Commander's Intent
  - rules of engagement (ROE)
  - coordination guidelines

  - schedule of operations
  - communication schedules
  - battlespace management
  - sensor employment and management plans/guidance
  - threat assessment
  - environmental guidance
  - common tactical picture [CTP]

This information and knowledge is understood by people but must also be available and used by automated systems!
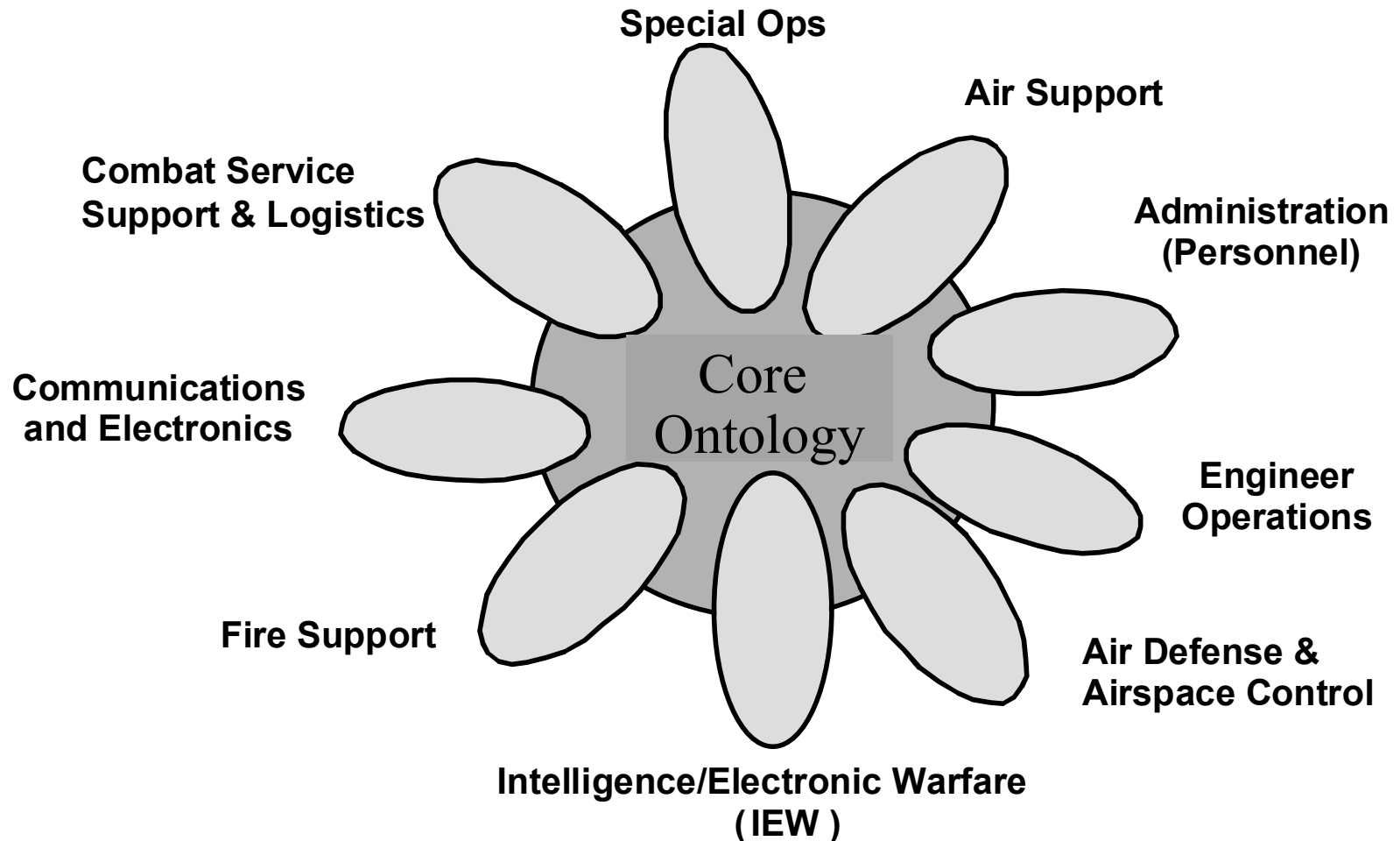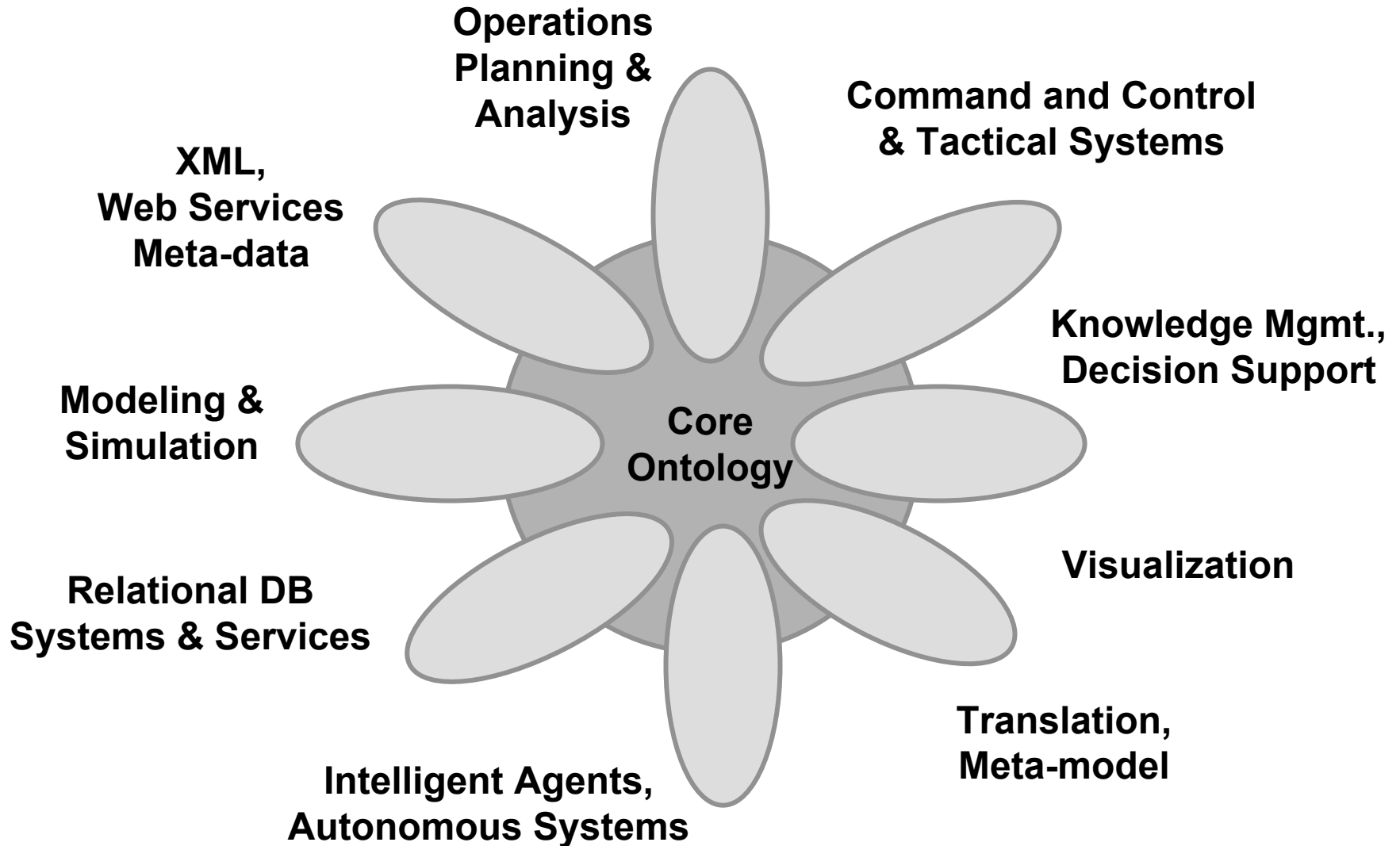
Global Information Grid

Context Driven

Operational Context

Shared Sensed Picture

Applications

Agents

Autonomous Systems

Sensing

Sensor Driven

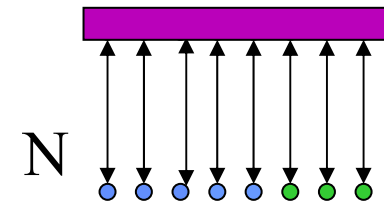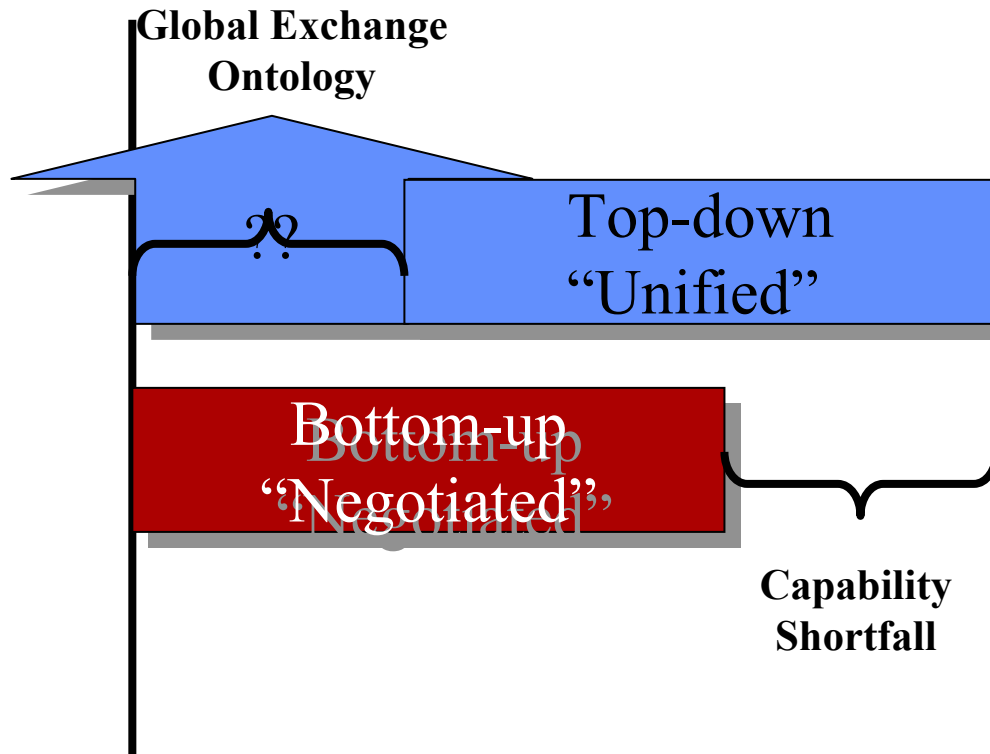Future Systems: Sensor *and* Context Driven

Achieving Shared Understanding

Core Ontology

Special Ops

Air Support

Combat Service
Support & Logistics

Administration
(Personnel)

Core
Ontology

Communications
and Electronics

Engineer
Operations

Fire Support

Air Defense &
Airspace Control

Intelligence/Electronic Warfare
(IEW)

Cross Domain Interoperability

Operations Planning & Analysis

Command and Control & Tactical Systems

XML, Web Services Meta-data

Knowledge Mgmt., Decision Support

Modeling & Simulation

Core Ontology

Visualization

Relational DB Systems & Services

Translation, Meta-model

Intelligent Agents, Autonomous Systems

Capability Gaps
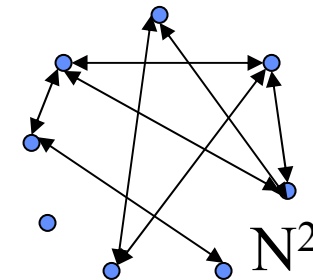
Why migrate to C2IEDM?

- History of LC2IEDM now C2IEDM

- Developed by NATO data modeling experts (ATCCIS Permanent Working Group)

- Based on the Information Exchange Requirements on the Battlefield

  - *Unambiguous Representation of Information*

  - *Extensible Data Model*

- NATO Standard ADatP-32

- Use by the NATO Data Administration Group

- Core Data Model for various C4I Systems

- Reference Data Model for various Simulation Systems

- Data Model for Multilateral Interoperability Program (MIP)

High Level View of C2IEDM

- **Very well documented**
  - Tables
  - Attributes
  - Relations
  - Extension rules
- **XML tags**
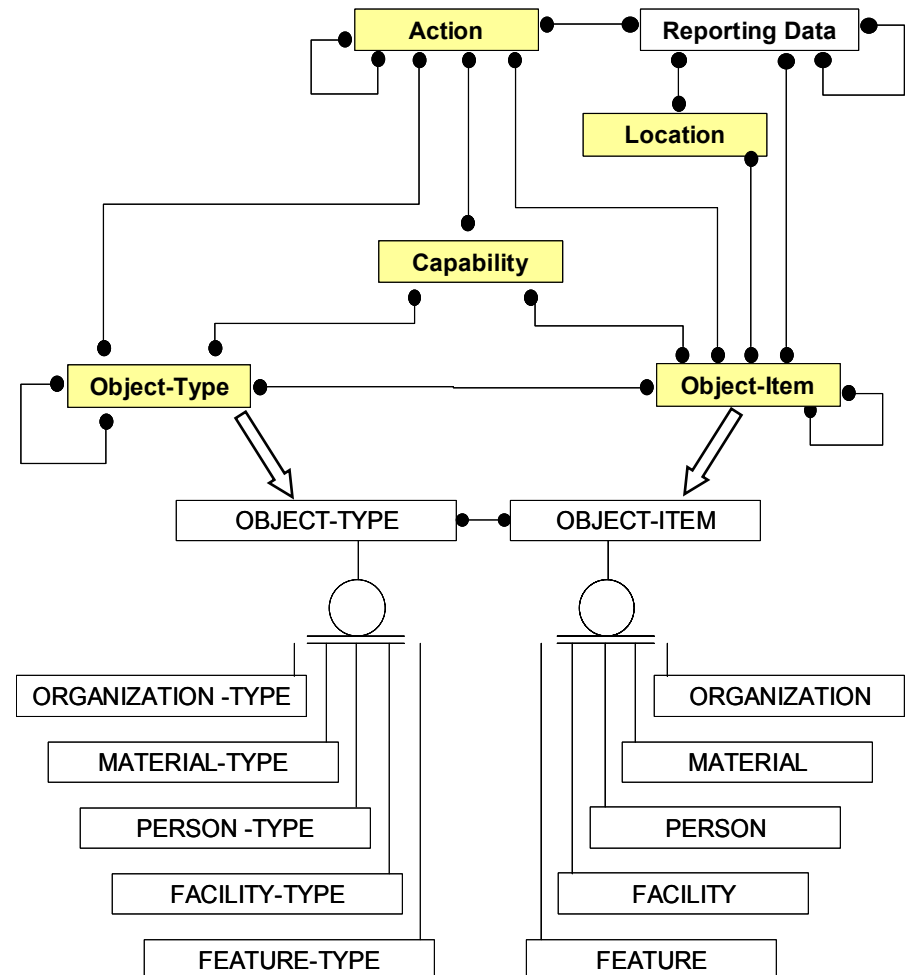
Who is using C2IEDM

- **International**
  - NDAG
    - IER between C4I Systems
    - Standard Data Elements
  - MIP
    - Data Exchange
  - German Data Management Group
    - Reference Data Model for Simulation Systems
  - France, Italy, Spain, …
  - New NATO Nations

- **United States**
  - Joint Staff
    - Situational Awareness Data Interoperability (SADI)
  - US Army
    - MCS, BML, CROM, and Other
  - NUWC, Newport, RI
    - The Technical Corporation Program (TTCP)
  - Naval Postgraduate School, Monterey, CA
    - Battlefield Generic Hub
  - Institute for Defense Analysis, Alexandria, VA
    - Data Alignment Studies
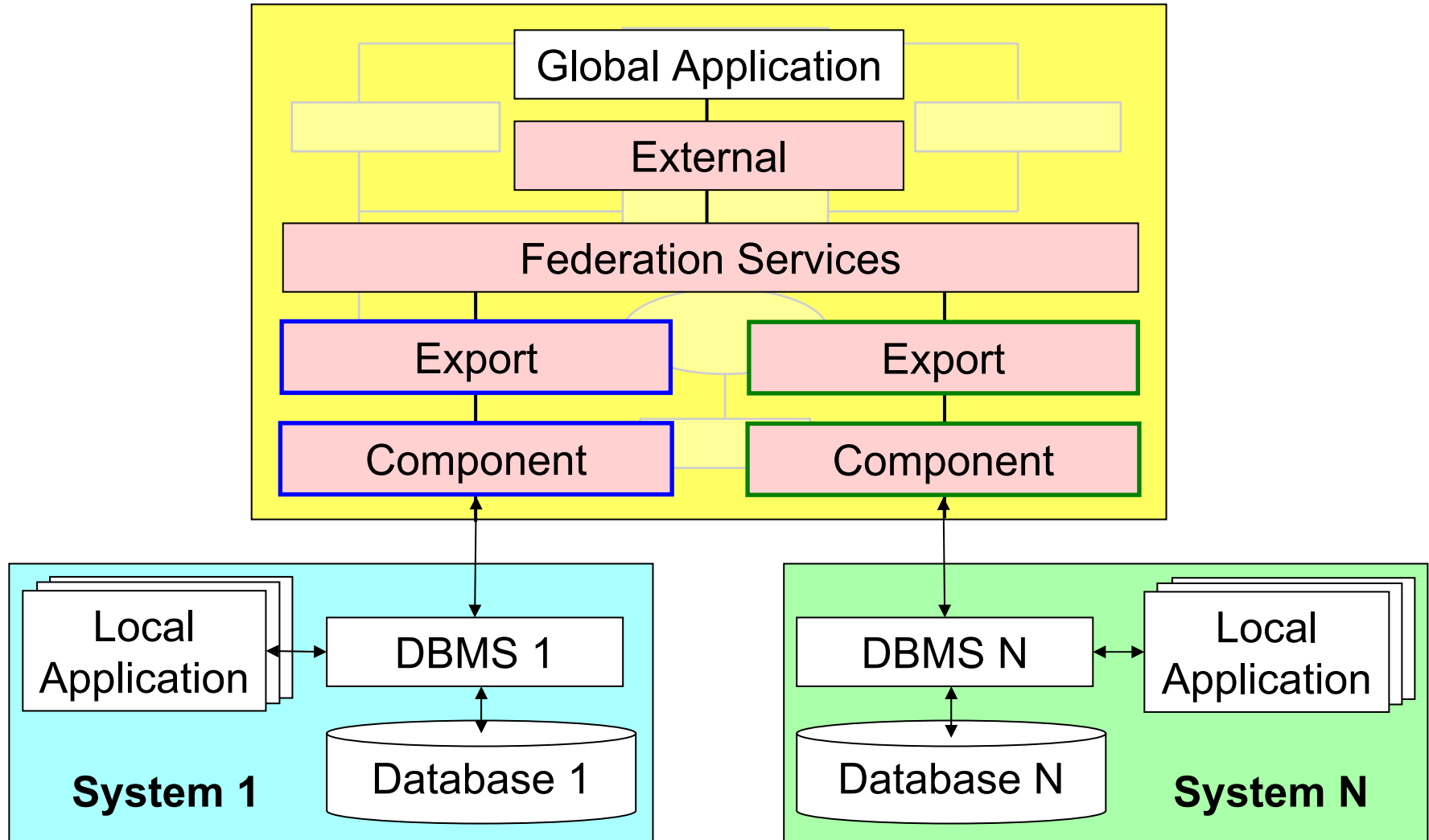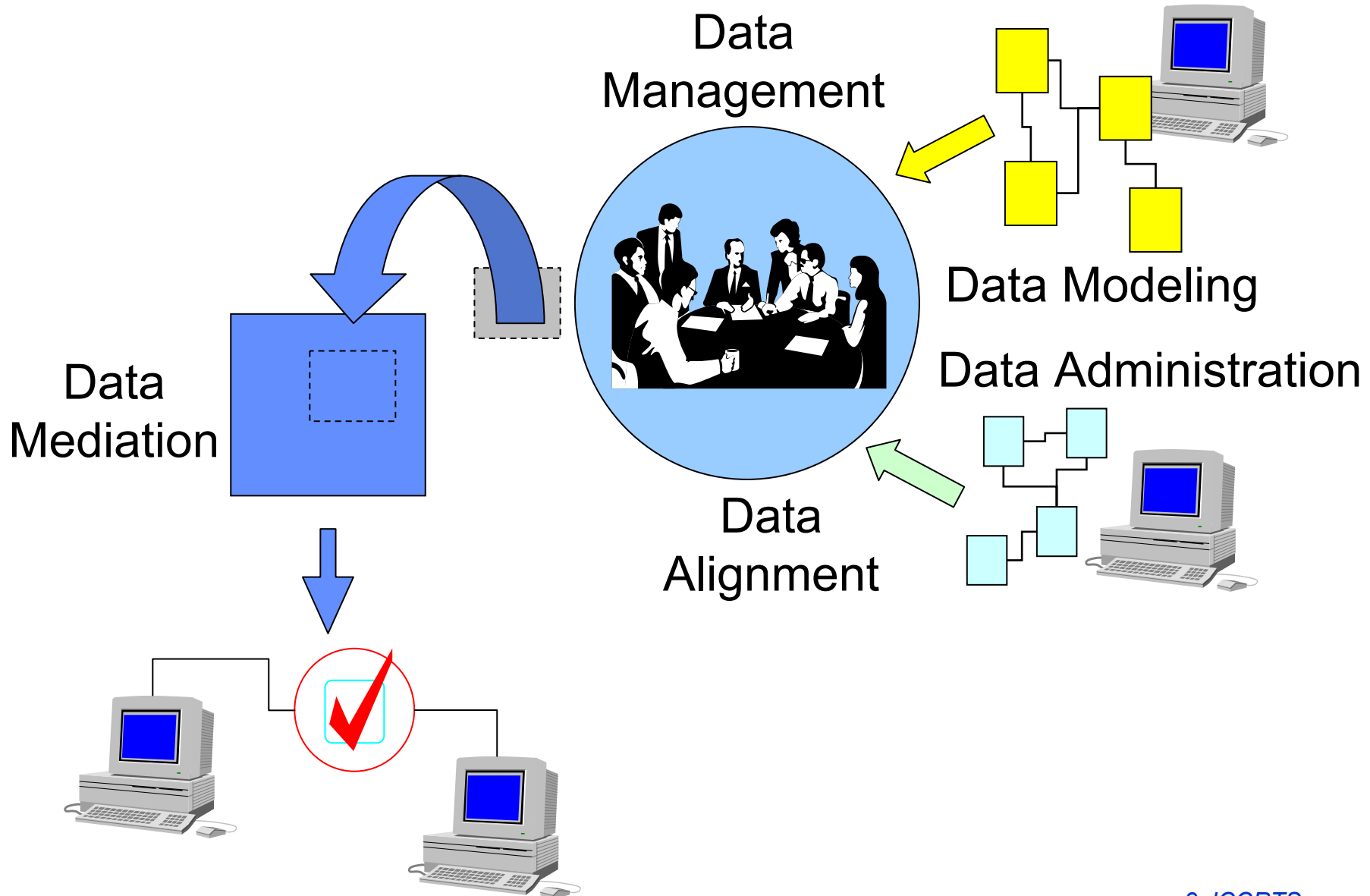
Overall, growing interest in C2IEDM

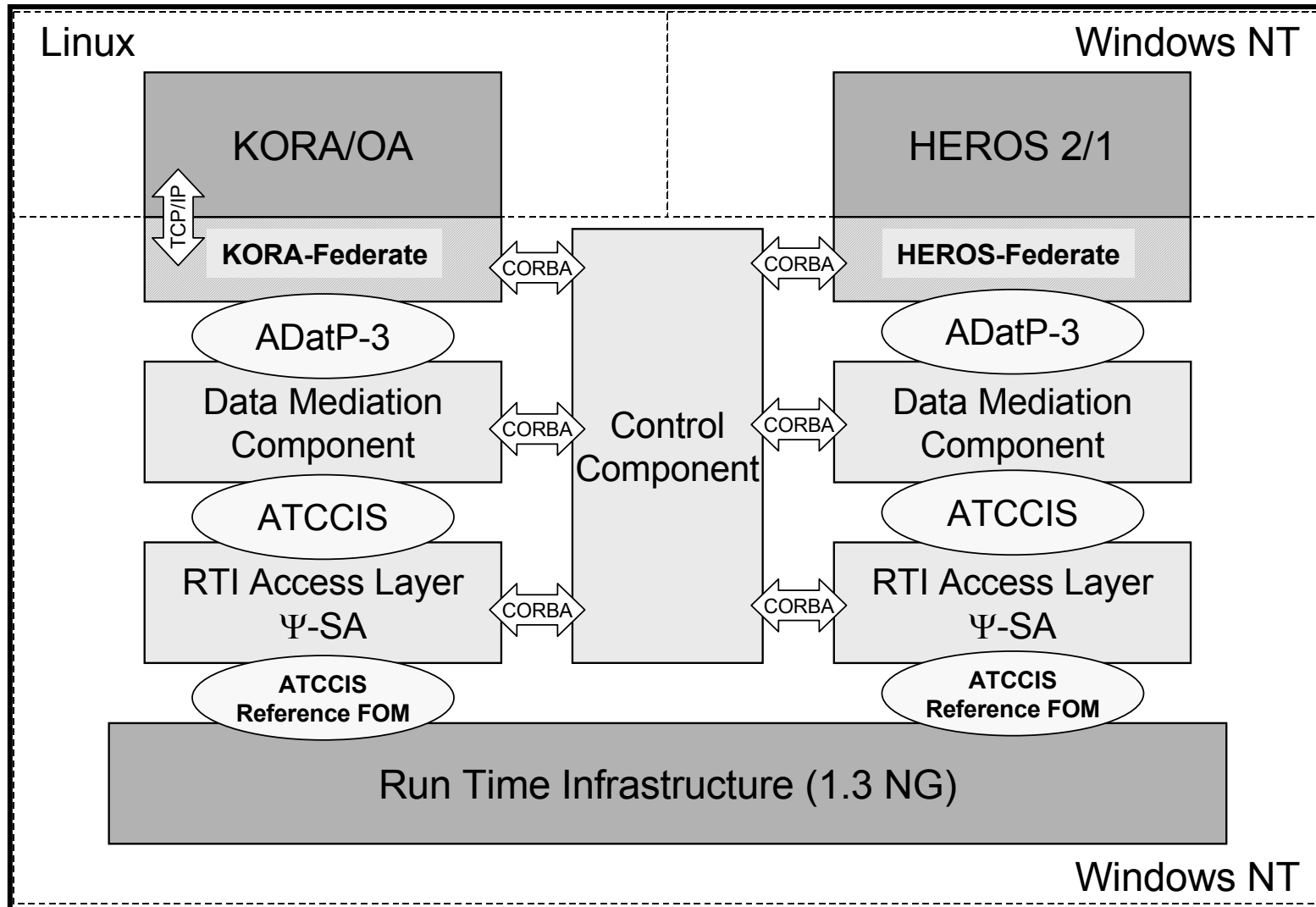# C2IEDM as an Extensible Ontology/Epistemology

- Ontology:
  - Theory about the nature of being or the kinds of existents
- Epistemology:
  - Typology for the ontology, theory of the nature and grounds of knowledge (in particular limits and validity)
- **Characteristics** of C2IEDM
  - Describe everything that is known actually
  - Define rules for extension in a way that will not affect the already modeled knowledge
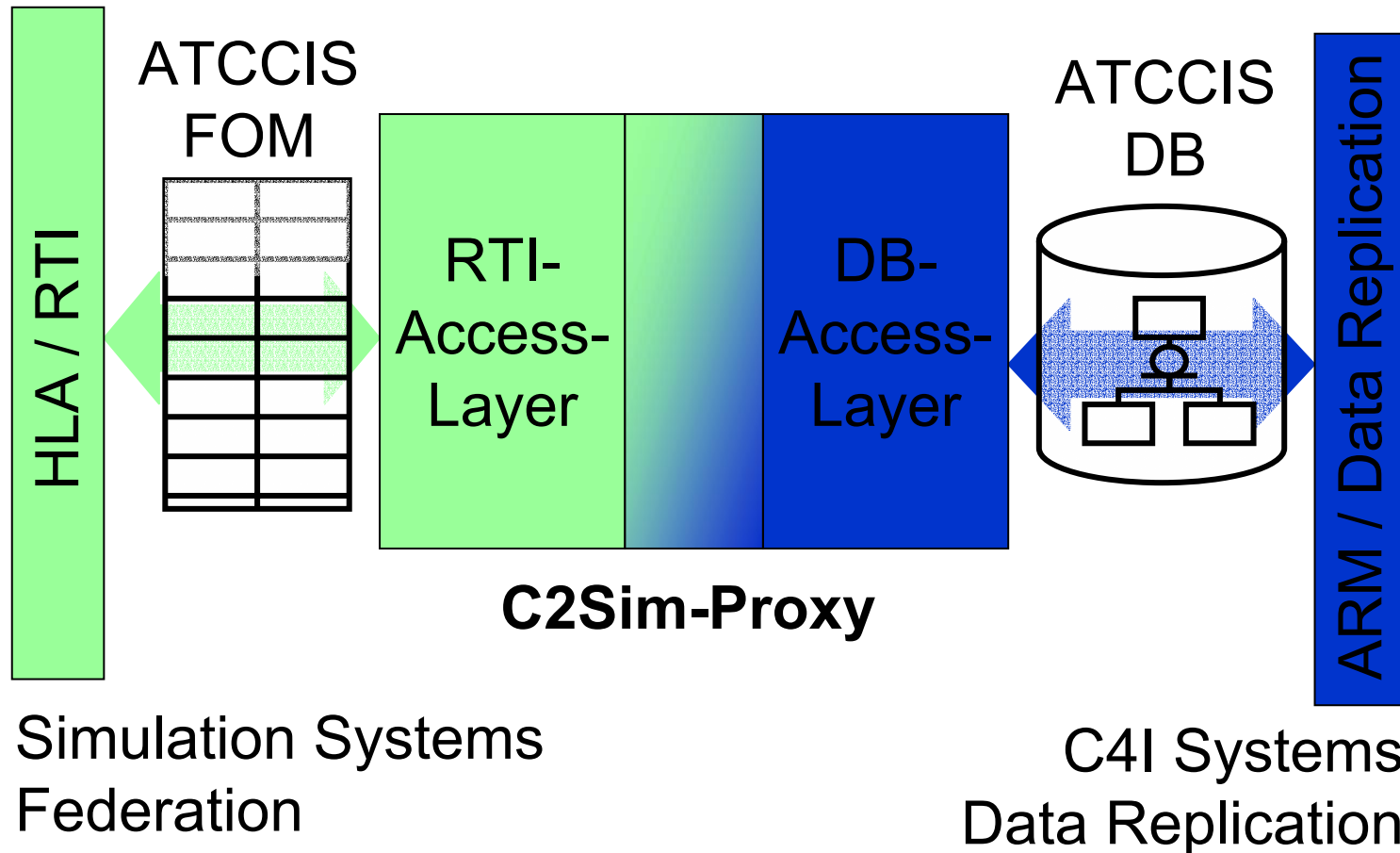
How to use the C2IEDM

- C2IEDM is not "a relational data model"
  - Unambiguous semantic by standardized data elements (SDE)
  - Unambiguous extension rules
  - Notation using IDEF1X
    - UML Object Model
    - XML SDE Repository
    - HLA FOM
- C2IEDM is a **Common Reference Model**
  - Information Exchange Definition
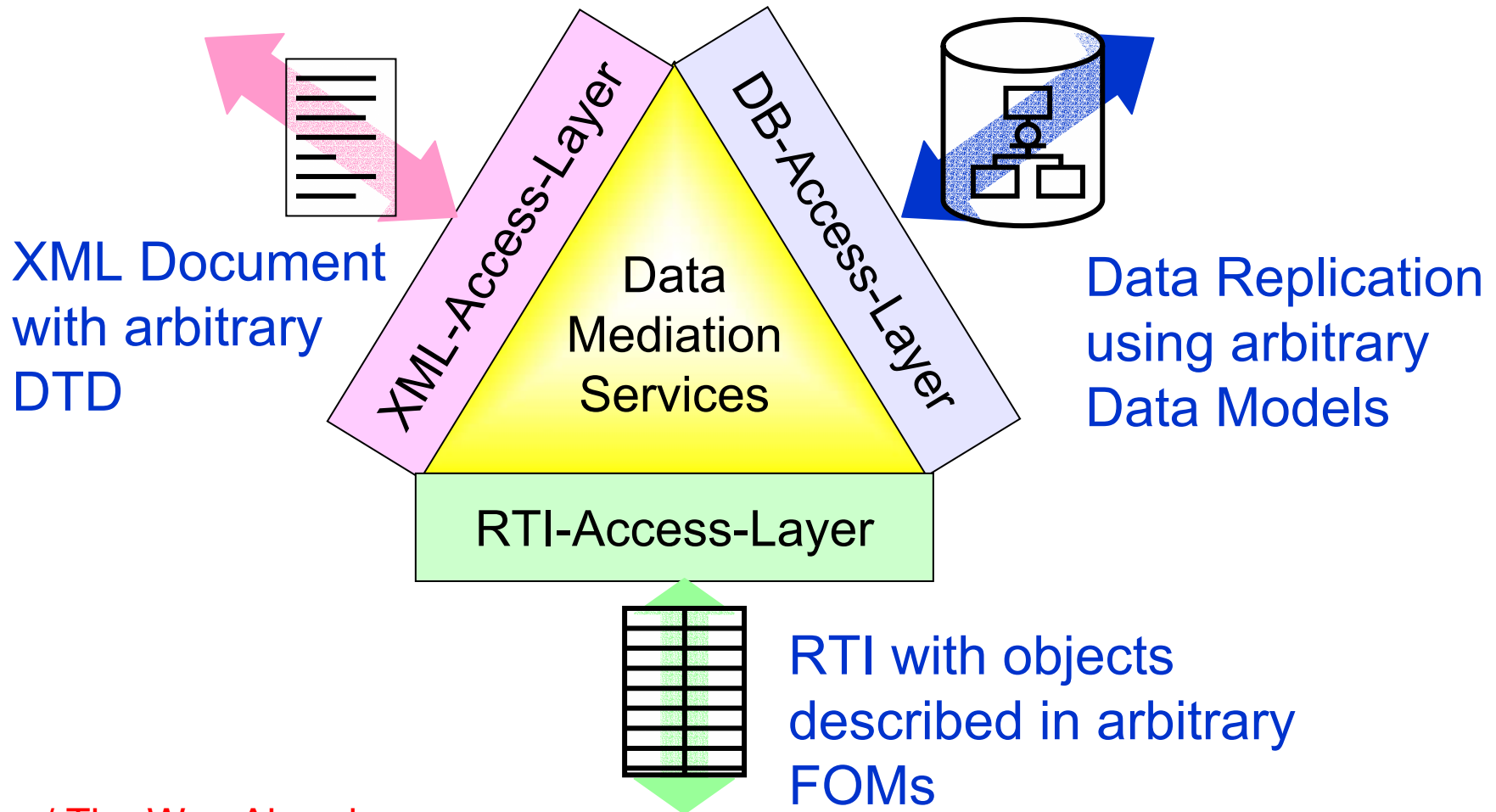 - Extension on an As-Needed Basis

Data Management

Data Modeling

Data Administration

Data Mediation

Data Alignment

First Version of the C2SIM-Proxy

Target Architecture for the C2SIM-Proxy

XML Document with arbitrary DTD

XML-Access-Layer

Data Mediation Services

DB-Access-Layer

Data Replication using arbitrary Data Models

RTI-Access-Layer

RTI with objects described in arbitrary FOMs

/ The Way Ahead

Summary

- To achieve the information age transformation envisioned by DoD leadership will require sharing a broader range of information and context.

    – Shared semantics and syntax make this more practical and affordable

- To enable information systems to find and reason about the information on the GIG we will also need to carefully mark it up with meta-data that has known semantics and syntax.

- C2IEDM provides a well designed, international, generic, extensible core ontology for military operations.